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PRESS BULLETIN No. 60

OF THE

N. C. GEOLOGICAL AND ECONOMIC SURVEY.

JOSEPH HYDE PRATT, STATE GEOLOGIST,
CHAPEL HILL, N. C.

Forestry Division:
J. S. Holmes, Forester, and Secretary N. C. Forestry Association.

RELEASED FOR PUBLICATION MARCH 9, 1912

THE SOUTHERN PINE BEETLE AND ITS CONTROL

An Address Delivered by E. B. Mason, Entomological Assistant Bureau of Entomology, Department of Agriculture, at the Second Annual Convention of the North Carolina Forestry Association, Raleigh, North Carolina, February 21, 1912

GENTLEMEN:—It is a great pleasure for me to be present at this meeting for three excellent reasons:

First. Because the first State recognition of our efforts to show the people of the South how to save their pine from the attacks of the Southern pine beetle was from North Carolina.

Second. Because to the coöperation of the North Carolina Forestry Association, with those interested, was due the formation of the Mecklenburg Pine Beetle Association and the Gaston Forestry Association, which were followed by the formation of similar organizations in other Southern States.

Third. Because these two associations formed for fighting the beetle are not merely names, but have actually performed the work for which they were organized.

I look forward with confidence to a time within the near future when we can say that the people of North Carolina have established systematic insect control for the benefit of every pine timber owner in the State.

I do not think it necessary for me to dwell on the seriousness of the situation in regard to the Southern pine beetle. There is not a man here who has not seen the appalling amount of dead pine. This dead pine is gone. We can not bring it to life again, but we can, and I am sure we will, try to stop the dying of further large quantities of timber. Since it is possible for us to make efforts in this direction it seems to me that we should look on further loss from this cause as absolutely unnecessary, and hold no one but ourselves to blame for it.

The Southern pine beetle has existed, to our knowledge, in the South

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for over forty years. It is only at long intervals, however, that it increases to such numbers as to cause widespread depredations such as the great invasion of 1890-93, which destroyed a large percentage of the pine in the Virginias and was only stopped by unusual climatic conditions. The warning sign of a depredation is the increase in number and size of the groups of dying pine. This warning has been only too plainly manifest the last two years. We have no reason to anticipate that any natural factor will come to our aid. We should be more than foolish if we based our hopes of relief on any such intervention of Providence. In other words, gentlemen, it is distinctly and plainly up to us.

In order that you may understand the reasons for the methods of control we advise, I am going to run through the life history of this beetle, beginning with the early summer, as outlined by Dr. A. D. Hopkins, who is the authority on forest insects of the Department of Agriculture, Bureau of Entomology.

The beetles attack and leave a tree in about thirty days or even more quickly. Three or four generations in the North and four or five in the South develop during the season. In other words, they may be increased thousands of times from their original numbers during the year. They fly during the night, and sometimes in the day, and alight on the upper trunk of a living pine. (Observation has shown that they seldom go as far down as the first eight or ten feet of the butt cut, depending, of course, on the size of the tree.) When they alight on a tree they bore through the bark to the wood, but they do not bore into the wood. In the inner bark and marked on the surface of the wood they make those winding galleries with which you are all familiar. These galleries, crossing and recrossing, girdle the tree many times, thus killing it. The eggs are laid along these galleries, hatch into little grubs, which feed for a short time on the inner bark, and then go into the outer bark where they change into beetles with wings. The beetles bore out of the bark to the light, fly away and attack other trees. They can fly for three or four miles or more, may go in any direction, and, therefore, are a direct menace to all pine within three or four miles of a center of infestation.

Since they kill and leave a tree in thirty days or even more quickly, you will never find their broods in old dead trees or trees from which the foliage has fallen. You will find many other kinds of beetles in old dead trees, but never this one. You will find this beetle in trees on which the foliage has begun to fade to light green or has faded to yellow or greenish brown. In fact, after November 1st, any dying or dead trees which retain their foliage are apt to harbor the hibernating beetles, and in addition they are also found in trees on which the foliage is green but which have pitch tubes on the trunk—these trees fade later.

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After November the beetles remain in the trees and instead of coming out in thirty days they don't come out till spring.

You have been trapped. That is the time to go after them. It is only necessary to cut down the trees containing the beetles and destroy the bark in which the broods are spending the winter. You do not have to destroy the wood, you do not even have to destroy the tops and laps.

Bear in mind that the beetles have left the old dead trees from which the foliage has fallen. The old dead trees may be totally disregarded in control operations.

About destroying the bark in which the broods of the beetle are wintering, it can be destroyed in several ways and in most cases in such a manner as not to involve a direct expense.

The tree in which the beetles are spending the winter may be turned into cordwood. This cordwood should be burned, however, and care should be taken to gather up the bark that falls in cutting between November 1st and May 1st.

These same kinds of trees may be turned into timber, but the slabs with the bark on must be burned between November 1st and May 1st.

There are other methods, but these are the principal ones. In all methods the underlying principle is the same—the destruction of the bark in which the broods of the beetle are wintering.

You notice I have confined control operations to the winter. There is an excellent reason for this. The cutting of any dead or living pine during the summer months in a bettle infested country will attract the beetles from three or four miles. They will go to some extent into the fresh felled green timber, but the greater part of the attack will be against the surrounding healthy timber.

It is therefore a very dangerous thing to cut pine during the summer unless every one in the neighborhood cuts their dying infested trees at the same time and destroys the bark. Of course when the beetle is under control there should be no reason for not cutting timber at any season of the year.

I want to speak briefly of two popular errors. Some people will tell you that the dying of the pine during the last summer was due to the drought. Trees have been dying every month in the year in moist as well as dry localities, in wet weather as well as in dry weather. Drought is, therefore, out of the question.

Many people will tell you that the death of the pine is due to the sawyer or borer. This is a natural mistake, because of the size of the sawyer and the noise which it makes when at work. It is, nevertheless, a mistake. It has long since been determined that this class of borer never attacks a living, uninjured pine. It comes in while the beetle is working or after the beetle has left the tree.

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We can divide the problems to be met into two divisions: The woodlot proposition and the lumbering proposition.

In the woodlot proposition the owner uses his woodlot for his fuel supply. He can just as well use his infested trees for cordwood and thus control the beetle at no expense.

On large holdings where cutting is going on the desired result can be obtained by burning the slabs from the infected trees with the bark on. Where the timber is to be held and there is no market for cordwood, control measures must be conducted at direct expense. The question to determine is whether the amount expended will be justified by the timber saved. Disregarding the increase in the danger of fire from the dead timber and the very great possibility of an increase in the number of trees killed each year, I want to say distinctly to you that it *will* pay. The trouble with the large holders is that they do not know how much timber they are losing.

No lumberman who is suffering from inroads by the beetle, after he has made an investigation into how much timber he is losing, will hesitate for a moment in starting control operations. He will not hesitate any more than he would hesitate to go out and fight a forest fire—indeed an attack by insects differs only from a forest fire in that you have more time to fight it and I quote your forester, Mr. Holmes, as saying that more timber has been killed in the Southern Piedmont section of North Carolina by the Southern pine beetle than has been killed by fire.

Gentlemen, the proposition is up to every individual timber owner. Dr. Howard, Chief of the Bureau of Entomology, has put the resources of the Bureau at your service. We can only give advice, however. You must do the actual work. If all will help, if all will go at the very simple task before them without waiting for their neighbors to begin, we can control this beetle and save an amount of pine from dying, the value of which I should not dare estimate in dollars.

Gentlemen of the North Carolina Forestry Association: I have endeavored to put this matter before you as simply as possible. If there are any questions unanswered in your minds, do not, in justice to yourselves and to us, let me go away with them unanswered. I think you will agree with me that every man here who controls pine timber should get at this matter at once. It does not admit of delay. Realize that you are engaged in a labor not only for yourself, but for your neighbor, and indeed for the whole South, and let your watchword be, "Do it Now."

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PRESS BULLETIN No. 61

OF THE

N. C. GEOLOGICAL AND ECONOMIC SURVEY.

JOSEPH HYDE PRATT, STATE GEOLOGIST,
CHAPEL HILL, N. C.

Forestry Division:
J. S. Holmes, Forester, and Secretary N. C. Forestry Association.

RELEASED FOR PUBLICATION MARCH 13, 1912

The Stock Law and Forest Protection

By Hugh MacRae.

The question of Stock Law in its relation to forestry is so simple that it could be covered by a few emphatic sentences, but as this would savor of dogmatism and would not further the economic interests which we have met here to consider, I am going to ask you to let me surround the bare statement of facts with certain bits of information which I hope will emphasize the importance of this subject.

I shall speak of the longleaf pine forests of the coastal plain, because the problem there is simple and will serve very well to illustrate the subject. As to these forests of the coastal plain, could Nature have been more prodigal? Could we have been less appreciative? Here is a tree, the longleaf pine, of the very highest economic value, absolutely suited to soil and climate, which Nature insists on reproducing.

One growing or defective tree, left standing for two or three years after its fellows are taken, will reforest two or three acres of ground.*

The pine burrs begin to pop open on the coming of cold weather in October or November and scatter the winged seed or "mast," which is whirled in every direction by the prevailing winds of the winter.

Almost every seed can germinate, for it falls on an ideal seed bed of sandy loam, which is kept almost constantly moist by the frequent rains.

After a few warm days the seed sprouts and puts down its small tap root. As soon as the tap root digs its way into the sand it performs one of the miracles of Nature by straightening up and lifting the mother seed into the air. Now the little tree is nourished from below and fed from above. It is fed through the tips of the pine needles until all proper dangers are passed; and with the warm days of spring it soon is six inches high, and by fall it is firmly established in the soil.

*A forester would recommend leaving at least one seed tree per acre, and preferably two, to make the reforesting from seed quicker and more sure.—Editor.

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Compare this with the slow, expensive process of reforesting in Europe (with trees of far less value), where each tree is planted and replanted by hand.

It may be interesting to you to know that while I have been accustomed to going into the woods all my life, I never had the opportunity to observe the growth of the young longleaf pine from the seed, as above described, until after the stock law was passed in New Hanover County a few years ago. The hogs ran at large in that county and were so strenuous that they succeeded in making this phenomenon one rarely to be observed. Now you can see the longleaf pine reproduce itself everywhere.

Recently a gentleman from New York, who spoke Italian fluently, was questioning an Italian at St. Helena about the results obtained from the vineyards of the colony. It was noticeable that the Italian replied with great enthusiasm, and later when the gentleman was asked what was said he replied that there were no expressions in English to give the exact idea; but as near as he could express it the Italian said, "We can not understand why Nature has done so much for us, why she is so bountiful with the harvests. We feel that she has made a mistake."

The area of the coastal plain is somewhat in excess of ten million acres. If the value of reforestation is duly appreciated and the forests protected, there should be an increase of at least four million dollars per year to the value of the forests from the natural reproduction.

Can Nature do more for us in the way of providing forests? Why has she been so generous in soil and climate, in abundance of moisture? We can quite understand the Italian's point of view.

When we think of the vast areas of the earth's surface not adapted to reforestation and others where the forests, once destroyed, can not possibly be reproduced, we ought to be thankful and protect intelligently what has come to us as a gift.

At the moment we can not feel proud of the part man is playing. Because of ignorance and natural aversion to effort, he sets fire to the woods in order to give the benefit of the new growth of almost worthless grasses to almost worthless cattle, which are enabled thereby to get a scanty living. He ranges his hogs in the woods, when they would prove far more profitable if kept at home. From the time the pine mast falls* until the little tree is one year old it affords a natural delicacy for the hogs—but only a delicacy, from the fact that a hog has to cover so much territory to live on this scattered food that he evolves into a high-speed brute, like Kipling's "kangaroo."

The fires and the hogs are enough to complete the destruction; but

* Nearly all of the seeds of the longleaf pine are devoured by hogs before they have time to germinate. Those that by some lucky chance escape, and become seedlings, are rooted out, even after they reach several years of age, the succulent roots of the pine being relished by the hog.—Editor.

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add to these a few sheep which have the habit of eating the cone-like buds out of the tops, and the little trees, which have escaped other enemies, are killed.

Without being in possession of any figures obtained by scientific investigation, it might be safe to say that one fire-spreading man, with 20 hogs, 20 sheep and 10 cows, will keep ten thousand acres devastated.

Nature does not give up the fight, however. She attacks the hogs with cholera, the cows with tick fever, and the man with poverty; but with what terrific cost to civilization!

Let me tell you of one tract of ten thousand acres which reforested itself. The seeding period was fifty years ago when men were in the war and when hogs and cows were scarce. About one-half the timber on this tract is longleaf pine; the other half shortleaf pine. The reforestation did not cost the owner one cent. As it came easily, it was sold cheap; land, timber and all for $27,000. During the past five years this tract has paid the owners $27,000 in turpentine rent; has paid to the renter more than $100,000, I understand, in the value of the turpentine. The timber is worth at present stumpage prices over $50,000; and on a good market would be worth more than $75,000. The sawed value of the timber would probably be worth as much as $500,000. As the land alone is worth much more than the purchase price, we can see that Nature's gift on this tract must be considerably in excess of $200,000; or more than $4,000 per year. While this land has probably been fire swept during recent years, the pine tree after it is several years old fortunately has a bark which will stand fire. The fire retards its growth, but does not kill the tree after the first few years.

A friend told me of an experience he had in the pine belt where there was no stock law. He bought about five hundred acres from which the pine trees had been cut. About six years ago he fenced ten acres of it. Recently he visited the place and found all the land outside of the fence just as he had left it years ago. Inside of the fence was a beautiful growth of longleaf pine, not less than one hundred trees to the acre. This man is naturally a strong advocate of stock laws which will protect the forest.

In this connection it is well to consider the worthlessness of woods cattle. This was brought home to me recently. Some parties joined in a plan to carry on a small cattle feeding and dairying experiment which was to be enlarged if it proved a success. The manager was a Hollander who, while he understands cows, was a stranger to the cattle and methods of this country. He was struck with the cheapness of the woods cow and thought he could start with these and improve them. After feeding forty head of woods cattle until they had about consumed their value in feed, and after going through the trials of tick fever and working with the cattle all fall and winter, it became perfectly clear

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that the wise thing to do was to dispose of them and start over again; and the owners were glad to sell the cows at their original cost price, losing one-half of the capital, which had been used up in expenses.

Do we want forests? Yes. Not only because of their economic value in furnishing fuel, crossties, and material for building and for the manufacture of furniture; but because they help to regulate the rainfall and conserve the water supply, which is essential to the prosperity of the agriculturist; and because the forests have a favorable influence on the climate, making it more equable by protecting the country against the sweep of cold winds.

In an article written by W. J. McGee, which appears in a recent issue of the *World's Work,* it is made clear that the power of this country to support a very large population, one billion, with comfort, is directly measurable by the amount of available water supply—namely, the annual rainfall and that stored under the surface of the earth. He says: "The limit of our capacity for production and population lies not in the land or its living forms—both susceptible of immeasurable improvement—but in the supply of water on which life depends; for without water there are no plants, no soils, no animals, no men, no intelligence to control lower nature."

With the abundance of rainfall which we have in North Carolina the great future of the country undoubtedly lies in the direction of intensive farming. If it is water and not land which sets the limits to population, and the chief feature in preserving our water supply is the care of our forests, then indeed we must handle this problem without delay. Twenty-five acre-feet of water per year on five acres of land will enable a family of five persons to support themselves with comfort and contribute to the support of an equal number of persons engaged in manufacturing or other kinds of work. With ample water, in other words, five acres will yield an easier living than 640 acres, or a square mile, on the plains; and Eastern North Carolina will support easily one person per acre.

In Holland there is a section where five hundred people are comfortably suported on fifty acres of land.

I wish I had the eloquence to demonstrate convincingly that because of this fact of abundant rainfall we of North Carolina live in one of the most favored spots on the globe; but we are not rising to the level of our natural surroundings. We are allowing generation after generation to go by and miss this miraculous opportunity. It seems that we must suffer by falling short of our birthright.

It is common sense to proceed along the lines of least resistance, and to do the thing which can be done to greatest advantage.

We have met to consider ways of protecting the forests. It is obvious

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that forest fires must be avoided, and that ranging cattle and hogs must first be stopped.

The United States Department of Agriculture and the State Departments, make clear to us the great loss of profits to the farmer from tick fever and cholera, which are directly due to permitting scrub cattle and woods hogs to run at large. This information is interesting; but to be valuable we should apply the real remedy, which is the adoption of a *State-wide stock law.* If some of our farmers in certain sections are still too ignorant to be alive to their best interests, it is the duty of those who do understand this to insist that our Legislature shall take care of this matter. A development in one progressive line assists every other, and I think nothing will do more to help drainage projects, the building of good roads, better education, better home comforts, and more profitable agriculture, than the passage of a stock law; and these things mean the development of our country.

A State Stock Law then means that a man shall keep his cattle, hogs and sheep fenced in, instead of permitting them to roam at pleasure over the lands of other persons. If he owned sufficient land so that his hogs and cattle could range freely without interfering with others, we would not be so much interested in the problem; but even though this man owned land he does not have the rights over rainfall and climate. These are for the common good.

It is the function of good government to promote the welfare of the governed, to protect the weak against the unfair encroachment of the strong, and to do whatever is best for the interests of the majority of the people.

If forests are for the general good, and the protection of forests is advantageous to our civilization and necessary to our comfort, then we are justified in asking our Legislature, which should be composed of intelligent representatives and statesmen, to make the laws necessary for the protection of the forests.

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Forest protection - Forest fires - State - N.C.

PRESS BULLETIN No. 62

OF THE

N. C. GEOLOGICAL AND ECONOMIC SURVEY.

JOSEPH HYDE PRATT, STATE GEOLOGIST,
CHAPEL HILL, N. C.

Forestry Division:
J. S. Holmes, Forester, and Secretary N. C. Forestry Association.

RELEASED FOR PUBLICATION APRIL 10, 1912

To the Editor:

DEAR SIR:—From a recent conversation with a prominent editor of a daily and weekly newspaper, it is gathered that several of the recent Press Bulletins issued by the North Carolina Geological and Economic Survey have been too long to be used conveniently by many of the State papers. It has been determined, therefore, whenever possible, to condense such articles into comparatively short paragraphs.

Two or three such paragraphs may be issued on the same leaflet, but each will have a separate heading and can be printed by you in separate issues or at the same time, as may be desired, either with our heading or with one supplied by the editor.

The Forester of the North Carolina Geological and Economic Survey, Mr. J. S. Holmes, is shortly leaving for Europe, where he will make a special study of typical forest regions in France, Switzerland, Germany, and England. He expects to prepare short articles on the forest conditions of the regions visited, especially calling attention to methods practiced there which might be introduced into North Carolina or which suggest modifications of such methods which might be of value to the North Carolina owner of woodland. These letters will be issued from time to time as Press Bulletins of the Survey, and it is hoped that they will be found of sufficient interest to justify their publication by many of the State papers.

Very truly yours,

JOSEPH HYDE PRATT,
State Geologist.

FORESTRY DEPARTMENT
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A Lumberman on Forest Protection

Mr. E. B. Wright, General Manager of the Butters Lumber Company, of Boardman, N. C., who is one of the most prominent and far-sighted lumbermen of Eastern North Carolina, asks the following questions of the lumber consumers of the State—and that includes practically all of us:

Do the masses of the people realize that in a few years' time all the pine timber in North Carolina will be gone and that we will have to ship lumber in from the far northwest, from Canada and other places? Do you intend to build at any time in the future? If so, this question is of vital importance to you.

Do you know that in fifteen years' time the majority of sawmills will be cut out and that lumber will be practically doubled in price because of the long distances from which it will have to be brought?

Have you thought that with from one-quarter to one-half of the area of this State in woodland we ought to be able to grow sufficient timber for all our needs for all time to come?

Do you realize that because of the destruction of the young growth and reproduction by careless lumbering, by forest fires, and by loose stock, these forests are not producing one-fourth of what they should, and of what they will produce if protected?

Do you not think that it is time that we had some protection for what forests we have left? The future prosperity of our industries and the future price of lumber depends on you, the people of North Carolina.

Why should not you have a representative in the Legislature who will look after your interests in this matter? The man who is asking for your support in the coming campaign should help you secure protection for your forests and will do so if you ask him.

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Good Roads and Forests

North Carolina is thoroughly inoculated with the good roads germ. We are all agreed that we must have better roads, and the only difference of opinion is as to the best way to secure them. Last year North Carolina authorized the expenditure of more money for good roads than any other State in the South with the exception of Texas. The North Carolina county that is doing nothing to improve its roads is now away behind the times and will be left out in the forward march of progress.

The first effect of improved roads is to increase the value of the farmer's timber. Forest products from comparatively small areas of woodland have to be marketed over county roads because enough timber can not be secured in one place to justify the expense of constructing a logging railroad or a flume. Good roads greatly reduce the cost of hauling to market the lumber, ties, and other materials, and this saving is added directly to the value of the standing timber. It is estimated that in nearly every county in the State this timber would be doubled in value if the main roads were improved, and this has actually happened in those counties that have secured improved roads.

Unfortunately, what with lumbering and forest fires, few of us will have the amount of timber that we ought to have by the time the good roads reach us. The movements for forest protection and for good roads should go hand in hand so that the greatest advantage would result from both. In twelve or fifteen years' time we shall have very little timber to market unless the forests are given every opportunity to produce a second crop. Forest fires annually destroy enormous amounts of young growth and reproduction which, if protected, would produce forests of much more value than those that are now disappearing.

Let us get good roads in every county in the State, but let us not fail to take measures to secure material to haul over these roads, so that we shall reap the largest benefits from them. Forest protection is as important for North Carolina as are good roads, and all representatives who are sent to the Legislature from the various counties of the State should be definitely in favor of these two measures.

See that your representative is actively in favor of good roads and the protection of the forests.

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Do We Encourage Forest Fires?

The destruction caused by forest fires in North Carolina during 1911 was very little less than that reported for 1910, according to a compilation being made by the North Carolina Geological and Economic Survey, and soon to be published. Only one-third of the townships of the State have sent in reports, but enough has been learned from them to show that no great reduction in the annual damage done by fires has taken place. This damage is estimated to approximate $450,000, which includes estimated damage to young growth, which in many cases exceeds the damage done to the standing timber. The number of fires reported was 637, which is slightly less than those reported last year and slightly more than was reported for 1909.

The area burned over is given as 160,000 acres, which is less than one-third of the area reported burned over last year. The average area of each fire has in this way been reduced from 667 acres in 1909, and 820 acres in 1910, to 250 acres in 1911. This is the one encouraging feature of this year's figures. It seems to show that some attempt is being made to control fires after they once get started. It would, however, be much better to prevent the fires.

According to these figures, the average damage per acre burned over is steadily increasing. This was given as 66 cents per acre in 1909, 97 cents per acre in 1910, and $2.80 per acre in 1911. There are several causes for this very large increase in the average damage per acre, but the principal one, outside of the weather conditions last year, which seemed to favor destructive fires, and outside of the inaccuracies unavoidable in collecting these figures, is a growing realization by the people of the actual damage which is done by burning the woods.

How can the average owner of woodland in North Carolina stand an average loss of $2.80 per acre from fires, which, with proper precautions, should be prevented? Is it not time that landowners were taking some steps to prevent this annual and needless drain on their pocketbooks? Why does not every farmer make a point of asking his representative in the next Legislature to secure him adequate protection against this scourge? The various candidates are asking for support and they will be only too glad to find out what their constituents want, that they can justify the confidence of the electorate in them. Let the people talk this over with those who are seeking election to the next General Assembly.

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PRESS BULLETIN No. 63

OF THE

N. C. GEOLOGICAL AND ECONOMIC SURVEY.

JOSEPH HYDE PRATT, STATE GEOLOGIST.

CHAPEL HILL, N. C.

Forestry Division:

J. S. HOLMES, Forester,

RELEASED FOR PUBLICATION JUNE 20, 1912

A FORESTER'S NOTES FROM EUROPE

The Forester of the North Carolina Geological and Economic Survey, Mr. J. S. Holmes, is in Europe, studying forest conditions in France, Germany, Switzerland, Austria, and England, and will send back for publication from time to time notes regarding the forest conditions in these countries and the methods that they are employing to conserve and perpetuate their forests. He will also draw comparisons between the conditions as they exist there and in North Carolina and call attention to such forest methods as could be employed to advantage in this country. These notes will be published separately for each country, and it is believed that they will be of interest to all North Carolinians who have given any thought or consideration to the condition of our own forests.—JOSEPH HYDE PRATT, *State Geologist.*

FRANCE

1. RECLAIMING COAST LANDS.

There is great similarity in the dune country of southeastern France and that of "the banks" of North Carolina, except that now the French coast is protected from the advancement of the dunes by grass and there are forests all along the banks. In driving south from Arcachon one could easily imagine himself in the small area of forest which still remains on the North Carolina coast just north of Nag's Head. There is encountered the same broken and hilly country with trees and shrubs, the same deep, sandy roads, occasionally "strawed" with pine needles, and even the same broad-tired two-wheeled carts. But where the forests are now only found in a very few places on "the banks" of our coast, those of France form an unbroken line of forest for 170 miles along the Bay of Biscay. Land which 100 years ago was not only worthless and, like our banks, yielding practically nothing, but over these the sand was drifting inland, destroying streams, burying farms and even towns. All this has now been changed to most productive land, and this province, which had become a by-word with the people, is now one of the most prosperous in all France.

This has been brought about by the fixation of the shore dunes by planting on them a variety of sedge grass and raising pine forests at the back of the first line of dunes. The shore dune is now continuous, and has been brought to the proper shape by making barricades of brush

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around which the sand is settled by the wind. When these sand dunes have attained the proper height and shape they are planted in *"gourbet,"* a kind of grass which grows best when deeply covered with sand.

At the back of these dunes pines have been planted for many miles inland. Though some few trees are killed each year by the sand blowing on to or off them, the forest now reaches to within 200 or 300 yards of the shore dune.

The strip of forest nearest the shore from one-half to three-fourths of a mile wide, is reserved as a protection forest and no tree may be cut and only a few bled for turpentine, so that any possibility of the blowing of the sand will be avoided. The remaining forest, extending for many miles inland, is treated entirely on a commercial basis and is very profitable.

[The Geological Survey made a brief examination of "the Banks" of North Carolina in 1907, and recommended a plan by which the remaining forests on "the banks" could be preserved, the dunes planted with a sedge grass, and other areas of "the banks" brought back into forest. No provision, however, was made for the Survey with which to carry out its recommendation. —*State Geologist.*]

2. Turpentining as a Permanent Industry.

The people in the United States are in the habit of thinking their business methods more progressive and efficient than those employed in Europe; we are, however, often mistaken in this. In France the turpentine industry has grown in 125 years from almost nothing to a very important and remunerative business, and is now on a permanent basis; while in North Carolina, which 100 years ago was the center of this industry in the United States, it is now practically dead. In this connection we might learn a very valuable lesson from our neighbors across the water. Turpentining is going on in France throughout the whole of the pine forests of the southwest provinces; and yet, under present methods, there is no prospect of the industry diminishing. This is because only the trees which are soon to be cut are tapped enough to injure the tree. All other bleeding is done in such a way as to protect the vitality of the tree. Cups are used universally for catching resin, though until 30 or 40 years ago boxes were used, as they unfortunately are being used by us in the South. Bleeding is started as soon as the trees get large enough, which is at a diameter of 6-8 inches. Only one face, however, is cut on such trees. As the trees increase in size it becomes necessary to thin some out. Such trees are marked and bled severely for four or five years before they are removed. No tree is bled for more than five years consecutively, so that it has time to recover from the first bleeding before undergoing a second on the opposite side of the tree. After the trees reach an age of 60 or 75 years, they are bled severely for several years and then cut, the timber being sold for mine props, lumber, and other uses. By the time the final cutting is made there is usually a good crop of young pines coming on to replace the old ones, but if any areas have not reproduced, they are planted. In

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this way the land is kept at its highest producing power and the industry remains permanent.

There are hundreds of thousands of acres of land in eastern North Carolina which were once covered with pine forests, but which are now bare and which yield little or nothing to their owners. If these lands were allowed to grow up to pine and were managed on somewhat the same plan as the French pine forests are, North Carolina could again become entitled to the name of "the Turpentine State."

3. Controlling Mountain Torrents.

The distance from the sand dunes of the Landes to Grenoble, the key to the French Alps, is about the same as from Nag's Head to Asheville. This large town has about the same elevation as Salisbury or Charlotte, but is surrounded by high mountains, many of those in sight having snow on them all the year round. The land along the valleys and along the lower slopes is very valuable, being used largely for raising crops. One can see everywhere at this time of the year the farmers plowing between the vines with yokes of cows, the women walking backwards close in front of the team to keep them straight, switching their noses when they swerve to the right or the left. In strong contrast with this primitive though intensive method of cultivation, is the way the steep mountain lands are enabled to prevent erosion. Most of the forests are either owned or controlled by the government and are managed with the chief idea of keeping a good forest cover everywhere on the soil. Lumbering, however, is general, but only under the strictest supervision, great care being taken not to leave any large openings in the forest cover.

Large areas on these high mountains are, however, bare of forest growth, having been deforested centuries ago. The heavy rains caused destructive erosion, and, gathering rapidly in the stream beds, caused the caving in of the banks and the destruction of much of the valuable valley lands and crops. Such streams and their adjacent lands have now been taken over by the government, which has appropriated millions of dollars for "*reboisement* (reforesting) works."

Planting has been undertaken on extensive scales, but on many areas young trees will not take root until the soil which is often very loose and rocky is fixed.

The French forester must also be a thorough engineer. *Barrages* or retaining walls, without mortar, are built along the beds of the steep streams. The banks are held by wattle work—brush twisted and staked into a low fence. Wattle work is also used to hold steep slopes on the mountain sides, willow and cotton-wood being chiefly used because twigs of these species grow wherever they are put into the ground. When this is done the open places are planted in such species as elder, locust, ash, and cotton-wood, as these quickly make plenty of roots which help to hold the soil.

This is all very expensive, but it is considered to be absolutely essential to protect valley lands and prevent their increasing devastation.

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Seeing this makes one think of what is going on in our own mountains. The cutting of the mountain forests and in many cases the absolute destruction of the forest cover, without any regard to consequences, will undoubtedly bring about similar conditions, and one can not help but wish that the owners of the land or the members of the Legislature could all come over and see the forest problems that France is now successfully solving.

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PRESS BULLETIN No. 64

OF THE

N. C. GEOLOGICAL AND ECONOMIC SURVEY

JOSEPH HYDE PRATT, STATE GEOLOGIST

CHAPEL HILL, N. C.

Forestry Division

J. S. HOLMES, Forester

RELEASED FOR PUBLICATION JULY 3, 1912

TIMBER RESOURCES OF POLK COUNTY

Polk County borders the South Carolina line on the southeast slope of the Blue Ridge and is one of the smaller counties of the State, having a total area of only 165,120 acres.

The general slope of the county is to the east and southeast draining away from the Blue Ridge. The western and southwestern portions of the county are rough and mountainous, the highest elevations being White Oak (2,900 feet) and Tryon (3,200 feet) peaks in the southwest, and Sugar Loaf Mountain (3,900 feet) in the extreme northwest. Here the smaller streams are swiftly flowing mountain torrents which fall rapidly through deep narrow valleys. The rock formation, however, as a rule, prevents serious erosion. East of the mountains is a high plateau through which the streams have cut their way. Between the streams are broad rolling-topped ridges, providing some of the best corn and cotton land in the county. Along the streams, however, the land is often rough and broken and has not been largely cleared or cultivated.

Polk County is well drained by Green River, which flows across the middle of the county from west to east, emptying into Broad River just outside the county; and North Pacolet River, which drains the southwest corner of the county. On account of the comparative narrowness of Green River valley and rapid fall of the stream, there is an opportunity for large waterpower developments.

Polk is greatly handicapped by its lack of transportation facilities. The Southern Railway has only 10 miles of track within the county, barely crossing it at its southwestern extremity. A branch line to connect Tryon with the projected electric line from Gastonia through Rutherfordton to Asheville would open up the county and permit a rapid development of the agricultural and forest resources of the county.

With the exception of Cooper's Gap Township the county has adopted the taxation system of maintaining roads. The dirt roads are not in very good repair, but they are passable and with the exception of the mountain roads might easily be kept in good repair. A fine macadam road extends from Tryon to Lynn.

Landrum, South Carolina, Tryon and Saluda are the shipping points for the south end of the county and furnish limited markets for some

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lumber, cotton and corn. The produce from the north and east end of the county consisting chiefly of lumber, corn and cotton, goes to Rutherfordton, either for shipment or for consumption.

Over the greater part of Polk County the soil is deep red clay. In the east this soil which produces excellent corn and cotton crops when improved is found on the rolling hill tops. In the valleys there is usually an alluvial soil of sandy loam. Upon the higher mountains in the western part of the county a deep black rich soil is found which produces abundantly.

Most of the lands in Polk County have been broken up into small holdings. Farmers own most of the county in areas generally ranging from 50 to 200 acres. Only eight tracts, comprising in all about one-sixth the area of the county, exceed in size 1,000 acres each.

It has been gradually cut up and sold until now only a comparatively small area remains. Farmers and mill men are buying this mountain land and cutting off the timber as rapidly as markets and transportation facilities permit. Mountain land is offered by the speculation companies for from $3 to $5 an acre. Farm land in Polk County varies from $20 to $100 an acre, depending on its quality and the distance from railroads.

Land is supposed to be assessed at about one-third its actual value and it is generally felt that the tax is light and has no influence in preventing the holding of forest land.

At least fifty per cent of the mountains will undoubtedly be retained as forests, and in all probability the proportion will remain as high as sixty-five per cent, while at least thirty per cent to forty per cent of the entire lower section of the county is permanent forest land. At present the forest covers approximately seventy-five per cent of the total area of the county.

Two distinct forest types are found in the county. In the mountains of the western part the chestnut type prevails. Chestnut, chesnut oak, yellow poplar, white oak, black oak, red oak, lynn and cucumber constituting the principal species. Some pitch pine is found on the higher ridges and a little scrub pine. Shortleaf pine is confined largely to the lower slopes and may be regarded as an extension of the Piedmont forest into this type. In the typical uncut mountain forest the stand averages about 5 M to 6 M feet per acre, and is made up about as follows: White oak, twenty-five per cent; chestnut oak, fifteen per cent; chestnut, twenty-five per cent; poplar, twenty per cent; red oak, ten per cent, and hickory, five per cent.

On White Oak and Tryon mountains the chestnut is absent and the proportion of the other species is higher. Much of this type has been culled for ties, lumber and tan bark and the average stand is now about 3.5 M feet. The poplar and chestnut oak have been most largely exploited.

On the lower lands all variations of the main plateau type are found. With the exception of some large holdings owned by non-residents, most of this region has been cut over. The presence of shortleaf pine is very marked. The percentage of species will average about as follows: White oak, twenty per cent; post oak, ten per cent; red oak, five per cent; black

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oak, ten per cent; spanish oak, five per cent; shortleaf pine, forty per cent; scrub pine one per cent; poplar, five per cent; hickory, four per cent. The average stand per acre will probably not exceed 1.5 M board feet.

There are few stands of old field pine. In the mountains the old fields, which cover about twenty per cent of the total area, are restocking to sassafras, persimmon, sourwood, chestnut, poplar and locust. On the lower plateau not over five per cent of the land has restocked to pine. Most stands of shortleaf pine are mixed with scrub pine or the trees are open and limby with short boles and spreading crowns.

Cutover land in the mountains, where not injured by fire, is restocking very successfully to seedling poplar and locust and to chestnut and oak sprouts. Nothing remains to be desired in the way of reproduction if fires can be kept out. Cutover forests in the plateau region are reproducing usually to a thick stand of oaks with more or less shortleaf and scrub pine mixed through. Under favorable conditions the pine will probably form a larger percentage of the forest than it originally did, but not as large a proportion as is desirable.

As a rule the land has been more or less culled and there remains a stand of hardwoods from which most of the pine and poplar has been cut, or hardwoods and young pines through which are scattered pines which were too small to cut during previous loggings. There is a great deal of young scrub pine throughout the county and as it is seldom cut, it is restocking old fields and cutover land with dense young stands.

Of the thirty-two sawmills operated in the county all but three or four are in the Plateau section. The total ouptput of sawn lumber was in 1910 about 6,400 M feet annually, of which forty per cent was old growth pine, thirty-three per cent second growth pine, and the remainder about half each of oak and poplar. Besides this, about 720 M feet of poplar was whipsawed, and shipped as squares.

Something over 750 cords of tan bank were shipped in 1910, and about 800 cords of chestnut extract wood were sent to Old Fort.

Cross-ties are being manufactured largely by the farmers and hauled to the railroads. In 1910 the output was about 33,000 ties, three-fourths of which were hewed and the remaining fourth were sawed.

At present about half the chestnut oak cut for tan bark is left to rot. This tree is well adapted to the rougher mountain lands, and, as suitable tie timber is becoming scarce no trees should be cut until it will pay to utilize the timber as well as the bark.

Forest fires cause the greatest injury to the forests of the county. Vast quantities of reproduction are destroyed. Timber is attacked by worms as a direct result of the fire, while the butt cuts of many of the giant poplars, as well as other trees, have been ruined by past fires.

Stringent State fire laws should be enacted and enforced as the first necessity for forest conservation in Polk County. Seed trees should be selected and left when pine land is cut over, even if the oaks form the first growth the pine usually manages eventually to push through and will gradually overshadow the oak. When protection from fire is secured the main object of management should be to increase the proportion of shortleaf pine in the forest.

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PRESS BULLETIN No. 65

OF THE

N. C. GEOLOGICAL AND ECONOMIC SURVEY.

JOSEPH HYDE PRATT, STATE GEOLOGIST

CHAPEL HILL, N. C.

Forestry Division

J. S. HOLMES, Forester

RELEASED FOR PUBLICATION JULY 3, 1912

TIMBER RESOURCES OF RUTHERFORD COUNTY

Rutherford, with an area of 350,080 acres, is one of the western Piedmont counties which lies on the southeastern slope of the Blue Ridge. Its extreme western border extends from Sugar Loaf Mountain to Old Rumbling Bald, peaks of the Blue Ridge, both over 3,800 feet in elevation, between which flows the headwaters of the Broad River through the Chimney Rock gorge. A large part of the South Mountains are included in the northeastern corner of the county. The remainder of the county is hilly and rolling, the slopes becoming gentler toward the southeast. The entire county is drained by Broad River and its tributaries, which furnish considerable undeveloped waterpower.

The principal mineral deposits of Rutherford County are monazite, mica, and gold; none of these, however, are being worked to any extent.

Three lines of railroad cross the county, though, owing to the lines paralleling each other more or less, the outlying portions of the county are not as accessible as if the transportation facilities were more evenly distributed. The Southern Railway crosses the county in a southeasterly direction from Marion to Blacksburg, South Carolina, and beyond. The Carolina, Clinchfield and Ohio Railroad crosses the county from north to south paralleling the northern part of the Southern Railway; while the Seaboard, running from Rutherfordton east towards Charlotte, runs through the same strip of country as the Southern does from Rutherfordton east. A branch line of the Seaboard extends from Ellenboro south to two or three cotton mill towns in the southern part of the county. A trolley line from Charlotte towards Asheville has been projected, to run up the Broad River through Hickory Nut Gap.

The soil is the usual heavy red clay of the region, though areas of gray loam occur here and there. On the steep slopes erosion has been very serious and little attempt has been made to prevent it. About twenty-eight per cent of the county is cleared. Cotton and corn are the staple crops, and the output of these is steadily increasing through the improved methods of agriculture which are rapidly being adopted by the people.

The majority of land in the county is held in farms of from fifty to

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two hundred acres each, only five per cent of the area being held in tracts of five hundred acres and over. There are two classes of such holdings: first, the large plantations which rent out portions of the estate to be worked on shares, and secondly, the large areas of mountain land which are held chiefly by speculation companies. These lands are now being gradually disposed of to small farmers, mill men, and others, for development and exploitation. The value of land varies greatly according to its situation and its suitability for agriculture or to the amount of timber growing on it. Mountain lands are valued for taxes at from $1 to $8 per acre, while farm land along the rivers sells at from $50 to $100 an acre.

Both the mountain and the plateau types of forest occur in Rutherford County. The mountain or chestnut type constitutes eight per cent of the entire forest area lying along the slope of the Blue Ridge. The typical tree of this type is chestnut; poplar, oak, hickory and pine being the other important trees. The greater part of the forest area of the county, however, is covered with the typical forest of the plateau region, consisting principally of pine and oak. From about one-third of this Piedmont forest practically all the pine has been removed, though on some parts of this area the forest has always been more or less devoid of this tree. About thirteen per cent of the present forest area has at one time been cleared and is now growing up to old field pine, much of which, unfortunately, is the scrub pine, though in some places, especially at a distance from the Blue Ridge, the shortleaf pine predominates.

Taking the forest area as a whole, it was estimated that an average stand of 1,350 feet per acre was found, or a total stand of about 337,000,000 feet of timber for the county. Of this amount 84,000,000 was old growth shortleaf pine, 55,000,000 second growth shortleaf, 145,000,000 oak, 16,000,000 poplar, 15,000,000 chestnut, 10,000,000 hickory, and 6,000,000 scrub pine.

About fifty small sawmills were in operation in this county in 1910, all but three or four of which were run by steam, and practically all of which were portable. They cut about 19,000,000 feet of lumber, about half of which was old field pine, one-third forest grown pine, ten per cent oak, and less than five per cent poplar. In addition to the poplar cut by the saw mills, about one million feet were cut in the woods with whip saws and hauled as squares to the railroad.

Outside of several planing mills which buy and finish lumber for shipping, little manufacturing of timber is done. There are two sash and door factories: one at Rutherfordton and one at Forest City, while a good-sized veneer factory operates at the former place. A considerable amount of miscellaneous timber products are shipped from Rutherford County. In 1910 2,700 cords of pulp wood and over 1,100 cords of chestnut oak bark were cut and shipped, while 52,000 ties were delivered on the railroad. Five thousand shingles were also cut, but these were largely used locally.

Owing to its situation on the Blue Ridge and to its general broken topography, Rutherford will always have a considerable percentage of forest land. The original forest, which up to twenty years ago was over-

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run with cattle, is, since the passage of the stock law, growing up to a fine growth of young hardwoods wherever fire has been kept out. In the lower and most settled portions of the county fires are infrequent, but in the high mountains fires are of annual occurrence and cover large areas, doing enormous damage.

Many of the old fields which have come up to dense stands of second growth pine could be largely improved by thinning out a percentage of the trees. Under ordinary lumbering conditions the best trees are usually taken and the poorest, which unfortunately are often the scrub pine, are left to form a second crop and to reseed the area. Under this system these forests are rapidly deteriorating, whereas, if judgment was used in thinning out the timber and as much as possible of the scrub pine was taken, the second crop of timber would largely be shortleaf pine. Many of these old fields will eventually be recleared for agriculture, and so in these cases no definite methods of cutting need be observed. Others are too steep to be profitably cultivated, and should be looked upon as permanent forest land and managed so that the largest amount of timber of the best quality can be obtained from them.

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UNIVERSITY OF MICHIGAN

PRESS BULLETIN No. 66

OF THE

N. C. GEOLOGICAL AND ECONOMIC SURVEY

JOSEPH HYDE PRATT, STATE GEOLOGIST

CHAPEL HILL, N. C.

Forestry Division

J. S. HOLMES, Forester

RELEASED FOR PUBLICATION JULY 3, 1912

TIMBER RESOURCES OF McDOWELL COUNTY

McDowell has an area of 279,680 acres.

Its northwestern boundary follows the summit of the Blue Ridge, which reaches an extreme elevation of 5,893 feet on Mt. Pinnacle, the junction of McDowell, Yancey, and Buncombe counties, being broken, however, by several gaps whose elevations approximate 2,500 feet. The slopes of the Blue Ridge are very rough and broken, deep, narrow valleys alternating with sharp ridges. The remainder of the county is less rugged, although the Hickory Nut Mountains, the Huntsville Mountain, and the Linville Mountains attain considerable height, giving a somewhat mountainous character to the county.

The Catawba River drains about four-fifths of the county, the remainder being drained by several streams which flow southward into Rutherford County. No development of waterpower on a large scale has been attempted, though several small mills are run by water.

All the bottoms and about half the comparatively level rolling uplands along the Catawba River have been cleared and are now in cultivation. The hills a mile or so back from the river are mostly still in woods. Much of the plateau land southwest of Marion has been cleared, but a considerable part of this has reverted to forest. In the outlying parts of the county, the bottom lands along the streams and most of the level uplands, have been cleared, but the hilly and mountainous land is still in woods. Many steep hillsides which have been put into fields have proved unprofitable, and have been abandoned. It is estimated that not more than eighteen per cent of the total area of the county is cleared.

Though thirty-seven per cent of the area of the county is held in tracts of over 1,000 acres in extent, only three or four holdings come up to 10,000 acres and none exceed it.

McDowell is well supplied with railroads. The Asheville and Salisbury Branch of the Southern Railway traverses the county from east to west, while a branch line runs south from Marion. The Carolina, Clinchfield and Ohio Railway, which has recently been constructed, runs north and south, passing about two miles east of Marion.

The main wagon roads leading from Marion are very good for five

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or six miles, but those in the outlying sections need improvement. The condition of the roads sometimes puts a stop to lumber hauling in the winter and spring. The difficulty of building roads with easy grades through the mountains is considerable, and the washing caused by winter rains adds to the expense of maintaining them.

Agriculture is the chief industry and corn the staple crop, though small amounts of wheat and oats are raised. Practically no cotton is produced, the growing season being a little too short.

The cutting and manufacturing of timber gives employment during a portion of the year at least to a majority of the residents of the county, since nearly every farm has its woodlot. Other important industries are furniture manufacturing and tanning. The former is centered at Marion, where four factories use the greater part of the oak which is cut in the county in making bedroom sets and other furniture. The tannery at Old Fort, one of the largest in the world, consumes daily about 150 cords of chestnut wood in the manufacture of tannic acid, some of which is used for tanning hides at the factory, and some is shipped outside of the State. Hemlock and chestnut oak bark are also used. A small tannery at Marion uses considerable bark, chiefly chestnut oak.

Like others in this region, McDowell County was once completely timbered. A very small area of virgin timber remains, one tract being the 400 acre watershed of Clear Creek, on Mackay Mountain, from which the water supply of Marion is derived. There are also portions of Hicks Mountain and of Wood Mountain which have not been touched by the axe.

At the present time, nearly all of the forest land which comprises eighty-two per cent of the area of the county, has been culled of its timber, the remaining stand averaging a little less than 1,500 feet per acre. This gives a total stand for the county of about 337,000,000 feet, divided up into the following approximate percentages.

Oak, chiefly white, black, scarlet and chestnut oaks, thirty-three per cent; chestnut, twenty-one per cent; old growth yellow pine, including pitch pine, table mountain pine, scrub pine as well as shortleaf, nineteen per cent; second growth pine, of which about half is scrub and half shortleaf pine, ten per cent; white pine, nine per cent; and poplar five per cent. Hickory, hemlock, beech, maple, and other species makes up the remainder.

The chestnut slope or mountain type prevails in the western part of the county. This type forms eighteen per cent of the forest area of the county. It contains from twenty-five to seventy-five per cent chestnut timber, though the stand of this species is being rapidly reduced to supply the Old Fort tannery. White and chestnut oak are next in importance. There is some hemlock and a little pine. Yellow poplar is occasionally found, but the choicest trees of this species have long since disappeared.

Sixty-six per cent of the forest area belongs to the typical mixed hardwood and pine type of the Piedmont region, and about nine per cent to the oak type from which the pine has for some reason disappeared. These types have been pretty closely cut over, so that little old growth

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shortleaf is left. The old growth pine timber is mostly found on the high ridges of the mountains.

The old field type, comprising only seven per cent of the forest, is more abundant in the southeastern part. Shortleaf pine is the chief species, though it is generally found mixed with scrub pine, which establishes itself on old fields more readily than the former. Chestnut, poplar, and oak are also occasionally found in the mixture.

Over forty sawmills were in operation during the greater part of 1910. They were mostly small portable mills, set up in the woods, and moved after the timber in the immediate vicinity had been cut. They sawed nearly 12,000 M feet of lumber, 5,000,000 feet of which was oak, just over 4,000,000 pine—half old growth and half second growth—1,100 M poplar, and just over 600 M feet each of poplar and white pine. At the time of this examination there was no band sawmill in the county, but one was being built north of Woodlawn, which will cut timber from the watershed of Armstrong Creek.

Yellow poplar is largely whip-sawed into square timber from 4 by 4 to 12 by 12 inches in size. About 2,400 feet were thus cut by hand in 1910. These "poplar squares" are sold to dealers at Marion and elsewhere, who ship them to Norfolk, Philadelphia, New York, and other distant points.

The output of the minor forest products is heavier in McDowell than in any other of the Piedmont counties. It was calculated that in 1910, 9,130 cords of pulp wood were cut; 5,150 cords of chestnut extract wood; 1,900 cords of tan bark, 480 cords of hickory wood for handles, etc., and 46,000 railroad ties. This, with the whip-sawed poplar, amounts to about 1,842,000 cubic feet of timber, or nearly twice as much as the total lumber cut for that year.

Fires have done great damage, and a proper realization of their harmfulness scarcely exists. Nearly every fall they burn over large areas on Hickory Nut Mountains and on the Blue Ridge. They are usually caused either by carelessness in brush burning, by sparks escaping, or by deliberately setting fires to uncover chestnuts. Much of the timber in Old Fort and Broad River townships has been greatly injured by the frequent fires.

The absolute forest land—one-half of the county—will, if kept in timber and protected from fire, maintain a continuous supply of timber for fuel, lumber and other wood products sufficient for local requirements. The importance of the forest land of McDowell County to its citizens can not be overestimated.

The prevention of fires is the most important matter for those who wish to get the most benefit and the largest income from the forests. Every one should at least keep fires from his own land, and he ought to be willing to assist others to extinguish fires on neighboring tracts, even if owned by non-residents. In extinguishing a neighboring fire he protects his own land.

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